

Citation:

Redmond EC, Griffith CJ. Consumer food handling in the home: A review of food safety studies. *J Food Prot.* 2003 Jan; 66 (1): 130-161.

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Study Design:

Systematic Review

Class:

M - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To review food safety studies regarding consumer food handling in the home, as well as the need for the development and implementation of food safety education strategies to improve specific food safety behaviors
- The aim of the present review paper is to critically analyze 88 consumer food safety studies
- The review will provide information regarding similarities and disparities between knowledge, attitudes, intentions, self-reported practices and actual behaviors from studies on domestic food preparation.

Inclusion Criteria:

- Studies included in the present review evaluated consumers' knowledge, attitudes, intentions, self-reported practices and actual hygiene behaviors relating specifically to food preparation in the domestic kitchen
- Only studies that assessed individual consumers and targeted consumer groups were included for review
- Persons classed as consumers included anyone who prepared food on a regular basis and was not a professional food handler
- All research methods for data collection, such as surveys, interviews, focus groups and actual observations, were included and analyzed for review purposes.

Exclusion Criteria:

- Research has indicated that actual observed food preparation behaviors of trained food handlers from food service environments are safer than those of consumers, and therefore results of studies involving trained food industry workers were excluded to alleviate any bias of common findings and conclusions within the review
- Additional studies that were excluded were those predominantly based on risk perceptions

or other aspects of food safety, such as pesticide residues or bovine spongiform encephalopathy, as well as those evaluating hygiene behaviors in less developed countries.

Description of Study Protocol:

Recruitment

- An extensive search of previous literature was conducted to locate published and unpublished consumer food safety studies
- Electronic searches of computerized library databases and the screening of reference lists from relevant research papers and reports facilitated the identification of many published studies
- Internet browsers were used to search the World Wide Web, and responses from the Foodsafe listserv were used to obtain many unpublished international studies
- Attendance at international food safety-related conferences and personal communication with experts in the field resulted in the acquisition of additional studies.

Design

Systematic Review

Dietary Intake/Dietary Assessment Methodology

Not applicable

Blinding used

Not applicable

Intervention

Not applicable

Statistical Analysis

Studies were evaluated in terms of the research method implemented for data collection, the study size, the country of origin and the year of study completion.

Data Collection Summary:

Timing of Measurements

Not applicable

Dependent Variables

Food safety findings relating specifically to food preparation in the domestic kitchen

Independent Variables

Social cognitive components (consumers' knowledge, attitudes, intentions), observed hygiene behaviors and self-reported practices

Control Variables

Not applicable

Description of Actual Data Sample:

- **Initial N:** 88 consumer food safety studies were critically analyzed
- **Attrition (final N):**
 - 88 food safety studies regarding consumer food handling in the home, published over a 26-year period
 - The majority of all the studies conducted (55 studies) were between 1995 and 1999
 - After 1999, in only two years, an additional 26 studies were completed reflecting an increasing trend in foodborne illness incidence
 - Seven of 15 observational studies involved direct observations, out of which three (43%) were carried out in the US
 - No studies investigated consumer knowledge on desirable procedures required for effective hand washing and drying during food preparation
- **Age:** Collected from over the past 26 years
- **Ethnicity:** Not applicable
- **Other relevant demographics:** None listed
- **Anthropometrics:** None listed
- **Location:** The majority of consumer food safety studies in the last decade have been conducted in the United Kingdom and Northern Ireland (48%) and in the United States (42%).

Summary of Results:

Key Findings

- The majority of consumer food safety studies in the last decade have been conducted in the United Kingdom and Northern Ireland (48%) and in the United States (42%)
- Surveys were the most frequent means of data collection and were used in 75% of the reviewed studies, while focus groups and observational studies were also used
- It has been found that consumers have a high level of concern about food safety issues, but surveys have shown that many consumers appear to lack a clear understanding of basic food safety terms; 75% of consumers lack familiarity with the term cross-contamination and principles associated with cross-contamination
- Limited information about consumers' attitudes and intentions with regard to safe food-handling behaviors has been obtained, although a substantial amount of information about consumer knowledge and self-reported practices is available
- Observational studies suggest that substantial numbers of consumers frequently implement unsafe food-handling practices
- Knowledge, attitudes, intentions and self-reported practices did not correspond to observed behaviors, suggesting that observational studies provide a more realistic indication of the food hygiene actions actually used in domestic food preparation
- Consumer knowledge of pathogens was assessed in 12% of the surveys reviewed; survey questions containing the names of pathogens generated more responses indicating knowledge of those pathogens than did questions that did not mention pathogen names
- The majority of respondents (75 to 100%) recognized that handwashing is a necessary food safety practice, however, study results have also indicated that nearly a fifth of the sampled

population from the United Kingdom and the United States are unfamiliar with handwashing and drying procedures

- Up to 36% of United Kingdom consumers and up to 22% of United States consumers do not recognize the importance of using separate or adequately cleaned utensils for the preparation of ready-to-eat foods after these utensils have been used in the preparation of raw meat and poultry
- In the United States, survey results indicate that 46 to 60% of consumers do not know the ideal refrigeration temperature, and that up to 70% of consumers' refrigerators exceed the recommended temperatures
- 15 to 20% of consumers do not know what the temperature should be inside a piece of meat for it to be considered safe to eat
- 93 to 96% of consumers recognize that it is important to check the inside of chicken to ensure that it is fully cooked, but 88% of consumers think that a subjective measure is acceptable to determine the end of the cooking process
- 31% of consumers do not know that storage of food at room temperature may cause food poisoning, but 79% know that foods cool more quickly in a shallow dish
- 81 to 90% of consumers agreed that it is better to use different chopping boards for the preparation of raw and cooked meats, and 90% believe that the use of different utensils or washed utensils for the preparation of raw and ready-to-eat foods will help prevent food poisoning
- 62 to 100% of consumers always or usually wash their hands after handling raw meat and poultry and 87 to 92% of consumers always or usually wash their hands with soap and water before handling food
- 17 to 50% of consumers admit to failing to wash their hands after handling raw meat and chicken or before the preparation of a meal
- Up to 85% of consumers stated that they use separate utensils or surfaces for the preparation of raw and cooked foods, yet up to 71% of consumers also stated that they use the same utensil for the preparation of raw and cooked foods
- In 1999, the American Dietetic Association and the Conagra Foundation found that only 12% of consumers reported using a meat thermometer and in 2000, only 24% of consumers reported regularly using a meat thermometer
- 83% of consumers reported that they determine the end of the cooking process subjectively
- Self-reported cooling practices are the least studied; 86% of Australian consumers cool leftover foods at room temperature
- A recent study showed that 34% of whole chicken packaging is contaminated with *Campylobacter* and 11% is contaminated with *Salmonella*
- 66 to 83% of United Kingdom consumers failed to wash and dry their hands immediately and adequately after touching raw meat and poultry packaging
- 17% of homemade chicken salads prepared in a model domestic environment tested positive for *Campylobacter*
- One consumer food safety study examined the relationship between pathogenic microbial contamination from raw chicken and observed food-handling behaviors, and the results indicated extensive *Campylobacter* cross-contamination during food preparation sessions
- 80 to 90% of consumers failed to use separate parts of the kitchen for the preparation of raw and cooked foods
- 66 to 75% of consumers appear to wash and dry chopping boards or use separate chopping boards for raw chicken and ready-to-eat foods, whereas 23 to 61% appear to wash and dry knives or use different knives
- Based on US consumer food safety surveys undertaken from 1977 to 2000, large proportions of consumers reported eating raw foods of animal origin

- Since 1977, the prevalence of the consumption of undercooked hamburgers has ranged from 4% to 30% of sampled population; since 1997, some surveys have indicated that less than 5% of consumers report preference for and the consumption of medium rare and rare hamburgers
- Since 1994, the prevalence of consumption of undercooked or raw eggs has ranged from 5% to 56%; the levels of consumption of such eggs appear to have been consistent from the mid-1990's to present such that up to 50% of consumers may still consume raw and undercooked eggs
- One US study indicated that susceptible populations with high risk for foodborne illness continue to consume inadequately cooked runny eggs and pink beef burgers
- 64% of consumers failed to wash and dry utensils or use separate utensils for the preparation of contaminated raw chicken and ready-to-eat foods and 13% of the foods prepared by these consumers were found to test positive for *Campylobacter*
- 98% of American consumers reported at least one unsafe practice
- Although 86% of consumers indicated that they knew that the implementation of adequate hand-washing procedures can reduce the risk of food poisoning, only 66% of consumers report actually implementing such procedures
- Up to 100% of study participants failed to wash and dry their hands adequately after handling raw chicken and more than half of the participants failed to use separate or adequately washed and dried utensils for the preparation of raw meat and poultry and the preparation of ready-to-eat foods
- Even though 100% believed that hand washing after handling raw chicken to be an important food safety behavior, all of them failed to do as they indicated. Likewise, against the 100% agreement on using different chopping boards for preparing raw and cooked foods, only 43% did what they reported.
- Only one of the studies linked actual pathogenic contamination with observed food-handling behaviors; the results indicated extensive *Campylobacter* cross-contamination during food preparation sessions
- Despite the various nationwide food safety campaign attempts, unsafe food handling practices were still frequently in place during the preparation of food in a domestic environment
- An improvement in consumer food-handling behavior is likely to reduce the risk and incidence of foodborne disease.

Author Conclusion:

Over the past 26 years, a substantial amount of valuable information about consumer food safety has been collected. The key findings from this review are as follows:

- Epidemiological data from Europe, North America, Australia and New Zealand indicate that substantial proportions of foodborne-disease can be attributed to food preparation practices used in the domestic environment
- Interest in domestic food-handling practices has prompted consumer food safety studies internationally. The majority of these studies have been conducted in the United Kingdom and Northern Ireland (48% of the studies reviewed) and the United States (42% of the studies reviewed)
- 83% of the consumer food safety studies have been carried out since 1995
- Data on consumer food safety were collected through surveys (questionnaires and interviews) in 75% of the reviewed studies

- Only one of the reviewed consumer food safety studies linked actual pathogenic contamination with observed food-handling behaviors; the study's results demonstrated extensive cross-contamination
- Few surveys have evaluated consumer attitudes and intentions regarding domestic food-handling behaviors with a view to determining why some food safety practices are implemented and others are not
- Observational study results suggest that substantial numbers of consumers still implement unsafe food-handling practices. For example, up to 100% of study participants failed to wash and dry their hands adequately after handling raw chicken and more than half of the participants failed to use separate or adequately washed and dried utensils for the preparation of raw meat and poultry and the preparation of ready-to-eat foods.
- Knowledge of food safety concepts does not generally correspond to self-reported practices for most food safety behaviors. For example, although 86% of consumers indicated that they knew that the implementation of adequate hand-washing procedures can reduce the risk of food poisoning, only 66% of consumers reported actually implementing such procedures
- A consumer's intention to perform a food safety procedure does not always result in the implementation of that procedure. For example, although 85% of consumers indicated that they intended to wash their hands after handling raw foods, no consumers were observed to do so.
- Consumers demonstrated judgments of optimistic bias, perceiving themselves to be less at risk from foodborne disease than others and continuing to consume unsafe foods despite knowing the potential consequences of this behavior.
- Positive attitudes about reducing the risk of foodborne disease associated with specific food-handling practices did not necessarily result in the implementation of the corresponding food safety practices
- Self-reported practices did not correspond to observed food safety behaviors, indicating that when food safety concepts are known, survey data may be subject to social desirability bias. Moreover, inaccurate perceptions of what constitutes "adequate practices" are widespread. For example, consumers may consider rinsing hands under running water "adequate hand-washing or drying"; thus, survey responses may reflect inaccurate information about self-reported practices.
- Comparisons of self-reported practices, knowledge, attitudes, intentions and actual observed behaviors indicate that actual consumer food-handling behaviors may be represented more accurately by data obtained through observation than by data obtained through intermediary means.

Reviewer Comments:

- *Search terms and databases not described*
- *Study quality and validity not assessed in this review*
- *Authors note that social desirability bias may have had the effect of reducing the prevalence of the consumption of unsafe foods.*

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions

1. Will the answer if true, have a direct bearing on the health of patients?

Yes

2.	Is the outcome or topic something that patients/clients/population groups would care about?	Yes
3.	Is the problem addressed in the review one that is relevant to nutrition or dietetics practice?	Yes
4.	Will the information, if true, require a change in practice?	Yes

Validity Questions

1.	Was the question for the review clearly focused and appropriate?	Yes
2.	Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search terms used described?	???
3.	Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased?	Yes
4.	Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	No
5.	Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes
6.	Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes
7.	Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issues considered? If data from studies were aggregated for meta-analysis, was the procedure described?	???
8.	Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes
10.	Was bias due to the review's funding or sponsorship unlikely?	Yes